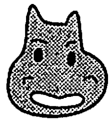


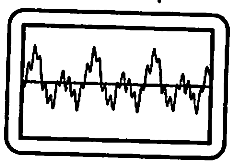
Since this is a Hippo school, I thought it would focus on literary topics. Hippo does mostly language-related activities, doesn't it? How did we ever get into math and physics? On top of that, how did we end up becoming involved in something as difficult as quantum mechanics!?

I didn't think we'd be doing math and physics either. . .

That's not true! It's not so hard.

I was thinking I'd like to do research on language at TCL, but. . .

Oscilloscope



Looking at the wave patterns made by sound, you can actually see words and other vocal sounds with your own eyes.

Then came **the Fourier series.**
Complex waves are aggregates of simple waves.

Follow along carefully, and without knowing it, you'll find that you've caught on.

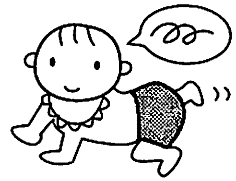
Without using the Fourier series, it was impossible to break the waves up.

That's how things stood when we decided to do Fourier. And when we did. . .

Mathematics turned out to be a language, too.
Physics is another language that describes nature.

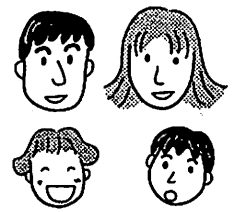
$f = ma$

That was a DISCOVERY!!



As a small child grows, he or she learns to speak.

→ The natural way



At Hippo, we start speaking new languages like children do. That's why we can speak so many languages in our happy Hippo family.

If we observe

carefully, that little baby can show us how language is acquired naturally!!

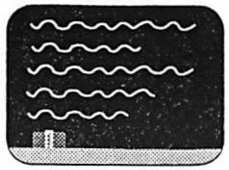
At TCL, that's what we call the natural science approach to language acquisition.

Mathematics and physics are no big deal at TCL.

Right.

They're languages, too! And they're easy and fun!

And something else. . .

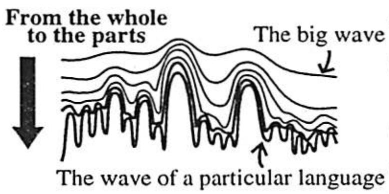


In the beginning, your head spins with all the equations on the blackboard.

But,

Math is a language, too. Think of the math you're learning as just another new Hippo language tape.

Quantum Mechanics

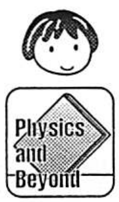


Even if you don't get all the finer points, it's enough if you absorb the general flow.

Gradually, as you listen again and again, you will pick up even the finer points.

Really, it's no different from learning by the other Hippo language tapes!!

Well, that may be so, but. . .



When you enter TCL, there's an assigned text called ***Physics and Beyond*** **by Werner Heisenberg.** You have to read it many times over.
Heisenberg was one of the stars in the world of physics.
We really wanted to know what Heisenberg had done. After we read his book, he felt like an old friend to us.

To enjoy
QUANTUM MECHANICS,
first listen to
THE OVERALL FLOW.
DON'T WORRY ABOUT THE DETAILS.

But, don't dismiss them entirely either.

It's important to put quantum mechanics together with everything you've been doing at Hippo.

Nonetheless, it's  who's going to be giving a talk,

and so you can't expect too much!

Just relax and enjoy reading!

With that,

Vámonos!!

In Chapter 1

Around the end of the 19th century, there were two ways of speaking about things in the world of physics.

1. Particles 

2. Waves 

There were a number of different ways to explain the movement of things, but they all came down to two types of explanations — particle explanations and wave explanations.

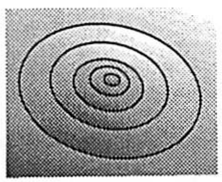
Particles and waves are by definition different things.

Particle

You can throw it.

Wave

When you place your finger on the surface of water, a wave forms around it and gradually spreads.



Waves are **continuous.**

Particles hop, and they are **discrete.**

I think waves are great. Which camp are you in, waves or particles?

Everything could be described in terms of one or the other. The descriptions were like two different languages. There were no problems and peace reigned in the world of waves and particles.

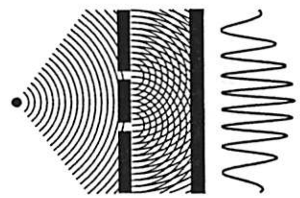
Happily, happily

A particle is a particle, and not a wave.
A wave is a wave, and not a particle.
The two were completely different.

The end

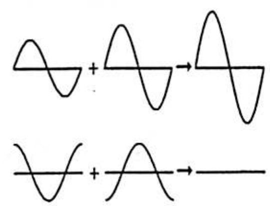
Now then. . .

was thought to be waves, not particles.



A characteristic of waves is that they expand and spread, and so if something interferes and leaves two openings, the waves pass through both openings and then come together again in a mixed pattern.

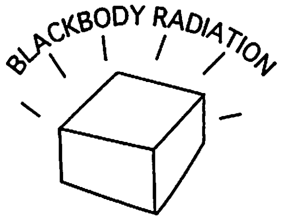
Wave Interference



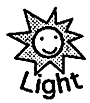
Waves are aggregates, the sum of a number of different waves. Some double when they combine. Others cancel each other out when combined, like the sum of a + and a −. The result is 0.

interfered, so one concluded that **LIGHT = WAVE**

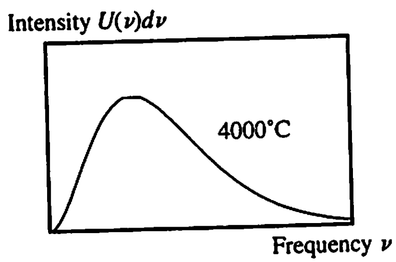
About that time, some of the research being done on light involved a box made of iron or something similar.



Inside, a vacuum was created, and the box was heated to a high temperature. As it got hotter, the inside of the box glowed. The energy of that light was investigated.

To investigate 

, you have to look at the **SPECTRUM.**



Do you know what a spectrum is?

When you use a prism, the light of the sun breaks up into colors. You can see the different colors that, mixed together, make up sunlight. A spectrum shows the proportions in which those colors are mixed.

Experiments were done, and spectra were identified.

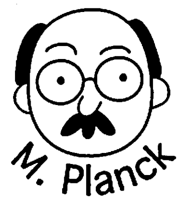
↓ Next. . .

You struggle to find some sort of equation that matches your experimental results.

You see, in physics, you have to test ideas. So you do the experiments first, and the results suggest what laws might be at work.

First the experiments! Actually trying it is crucial! You can't do physics without testing!

Everyone went through much agony and frustration, and then Mr. M. Planck found:



$$U(\nu)d\nu = \frac{8\pi\nu^2}{c^3}\frac{h\nu}{e^{\frac{h\nu}{kT}}-1}d\nu$$

Don't get too intent on the equation. It's less intimidating if you look at it with one eye closed...

Wasn't that great?

But. . .

It's terrific that earnest Planck formulated this equation, but once he had it, even he wasn't sure what it really meant.

In other words, when he formulated the equation, he did not think too much about its deeper significance. His immediate concern was to match experimental results. The finer shades of meaning were less important at that point.

Somehow that reminds me of Hippo.

Night after night,
he thought about it.

I mean, he couldn't make an equation and let it go at that, without knowing what it really meant.

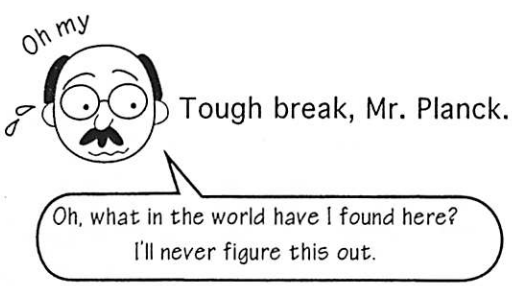
He concluded that. . .

The energy of light is measured in integral multiples of $h\nu$,
which is a specific number (h) multiplied by the frequency (ν) of the wave.

That is, its energy jumps by **discrete** amounts.

But if that is so, **a contradiction emerges.** Precisely because light is a wave (remember wave interference!), its energy should therefore be **continuous.**

A peculiarity of waves



Tough break, Mr. Planck.

The problem was that even though light comes in waves, the values for its energy seemed to be an impossible thing — jumping, discrete values.

As a mathematical expression. . .

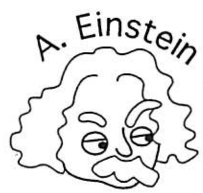
$$E = nh\nu \quad (n = 0, 1, 2, 3\cdots)$$

Energy

This is not simply a lowercase *h*.
It's called the **"Planck Constant."**
6.63×10^{-34} (joule·second)
Naturally, it's a value discovered by Planck.

If you can remember it, you'll really impress people!

And then. . .



THE GENIUS MADE HIS APPEARANCE!!

Mr. Einstein said:

"Light is a particle!"

A particle that has energy $h\nu$.

While everyone else was trying to figure it out, a genius spoke up, went beyond them all and settled everything. It was something so simple that no one had even thought of it. It's an incredible quality, and an important one.

Now that's what I call genius!

But simply making a claim about something is
NOT GOOD ENOUGH.

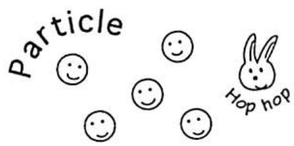
Unless you can actually show experiments where light is acting like a particle. . .

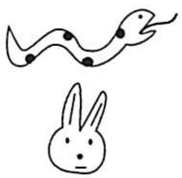
No matter how good it may sound, unless you can prove that really is the way nature acts, then we can't take it as truth.

Heh heh heh
There are such experiments. . .

PHOTOELECTRIC EFFECT
COMPTON EFFECT

You know, you don't have to understand all the details.

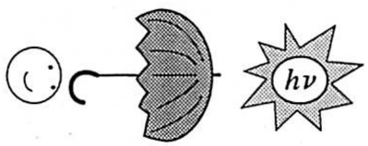




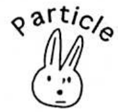
Something that could not be explained in terms of waves could be explained if you used the language of particles.

The way we get sunburned is one case of the photon effect. Ultraviolet rays contained in sunlight are of high frequency (ν is large). When ν is large, $h\nu$ is also large, meaning that the energy ($E = nh\nu$) is high.

So when your face is struck by particles with high energy, you become sunburned.

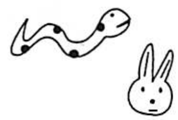


If you don't want to get sunburned, you should shade yourself using a parasol that ultraviolet rays cannot penetrate. How about that!

If  **is a**  **, What Happens. . .?**

WHAT HAPPENS IS QUITE STRANGE.

Can you believe it, sometimes light is a particle; other times it's a wave. It's a pretty slippery notion.



Waves and particles are absolutely incompatible. No matter how much they grow to like one another, they can't be together.

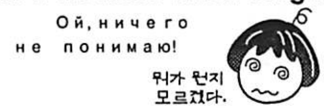
What should we do. . .!?

Until now we have always used the language of particles and waves to talk about things,

But maybe that's simply not possible. . .

What should we do. . .!?

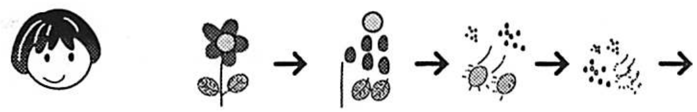
I wonder if we need a new language. . .



I don't understand at all.

In Chapter 2

At the time of Einstein, there was another very peculiar discovery. **It concerned atoms.** When you break something up into smaller and smaller pieces, you end up with tiny particles.



Then you reach a point where you cannot go any farther, and you are at the level of **the atom.**
Of course, it's a kind of particle.

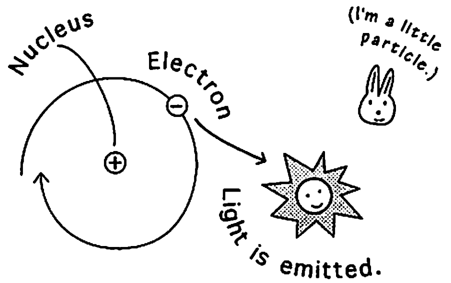
But it was eventually found that the atom was made of yet smaller things.

But **because it was so small, it could not be seen,** and it was difficult to determine the structure of the atom.

When you can't see inside, what do you do?

You sniff it.
You try shaking it.
You test its weight.
You hold it up to the light.
Etc. etc.

You can do all sorts of things, can't you. . .



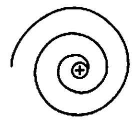
Probably. . .
There are electrons spinning around a nucleus.
When electrons move, they emit light.

That light can be observed.

Its spectrum can be analyzed.

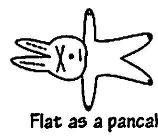
Maybe the electrons and the nucleus behave like the planets rotating around the sun.

But if we continue this line of thought, an electron can give off light only if it works hard,



and that means that **it** uses up energy.

When that happens, the electron loses force. Because the charge of the electron is negative and the charge of the nucleus is positive, the electron is gradually attracted to the nucleus and the atom collapses.



That means trouble.
After all, if that were so, even a person would suddenly become flatter than a pancake whenever energy ran out.
That never, ever happens!!

I think that's the wrong idea. . .

That's right.

It's a fact that atoms do not collapse, so let's revise our theory to show that they don't!

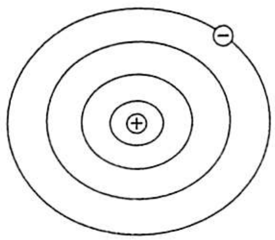
We need to make a substantive turnaround in our first premise, right?

I'm not really sure, but. . .
Let's just settle it!!

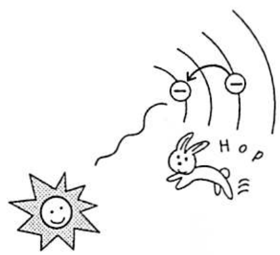
Electrons rotate about the nucleus, but they do not emit light. . .

Oh my, what a bold idea, but we all know that light has been actually observed.

- Bohr's hypothesis -



Inside an atom, there are orbits with fixed radii in which electrons rotate.



And when an electron jumps from one orbit to another, **it emits light.**

So if you think this way, our position is all right. We're into a new language for the atom.

Right! That's the bottom line. Rigid ideas are no good. Flexibility — that determines the power of thought.

Hey, wait a second.

I have a question. . .

Question 1. Why does an electron have to stay in a certain fixed orbit?
Question 2. When does an electron jump?

I don't know. . .
I noticed that too, and it puzzled me. . .
But in any case, an atom doesn't collapse into a pancake, and the light that is emitted from it has a certain fixed spectrum.

Taking that into consideration, this is what we end up with.

So you see, we need a special language for talking about atoms.

I'll have Heisenberg think about the rest.

Good idea.
It's easier to understand something you're having trouble with if you borrow everyone else's brains rather than grappling with it on your own.
Thinking together, all sorts of ideas come up.
Even listening to Hippo tapes, you get much more out of them when you listen with everyone else, instead of all by yourself.

At TCL, too, it's not about one person, but putting everyone's heads together.

That's why it's interesting.

At last. . .

In Chapter 3

Suddenly, the young Heisenberg makes his appearance.

A mi me gusta tocar el piano y la física.

No matter how long and hard you try, you can't see inside an atom. You can't know what's going on in there.

So, as for these notions about orbits, let's just forget about them!!

The problem is the spectrum of the light that the electrons give off. If I could only calculate and express it!

Building on the work of 

, he struggled forward.

A FORCED BREAKTHROUGH!!

At times, hammering away at a breakthrough is the best way. Hey look, sometimes you have to go at it hand and fist. Rah-rah!

Making skillful use of calculations done in physics thus far, Heisenberg was finally able to get his own calculations to work so he could express the spectrum of the atom.

Furthermore, he **formulated an equation** just for that purpose.

And how about this! There was actually a branch of mathematics called matrix theory, and Heisenberg, without knowing of it, ended up reconstructing it all on his own. AMAZING, isn't it?

I didn't know that mathematical theory was ever produced like that. But I suppose all of math actually was formulated in just the same way.

That's how it was. Really!

Mathematics is a drama too, isn't it. . .?

And then. . .

$$q = \sum_{\tau} Q(n; n-\tau) e^{i2\pi\nu(n;\, n-\tau)t}$$

$$H^{\circ}\xi - W\xi = 0$$

This expresses the electron jumping from n-th orbit to (n-τ)-th orbit. tau

I'm thrilled!!

I did it!

With this, the spectra of the light emitted by the atom made perfect sense!

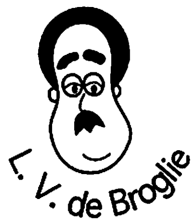
That's great, but there's no room at all to think about the orbits in the atom, right? So we're not supposed to think about the inside of the atom?

That is going too far.

No matter how perfectly you can discuss the spectra, that alone doesn't mean that you shouldn't consider the inside of the atom.

Hmm. . .

In Chapter 4



The nobleman de Broglie enters quietly on the scene.

Ladies and gentlemen,

We've thought of the electron as a particle.

Now, what if we thought of it as a wave?

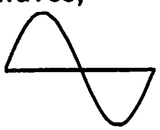
After all, light too was considered as particle. / wave.

Do you remember?

You see, if you think of it as a wave, then it is a matter of course that it can assume only fixed values.

That is to say. . .

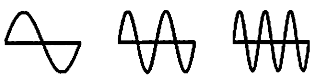
With waves,



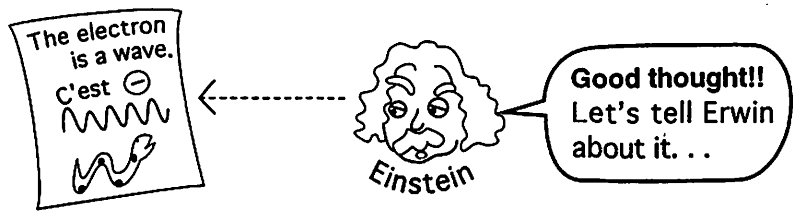
one cycle is always a complete cycle.

There are no in-betweens such as these,

and, no matter what, you get values constituted like this.

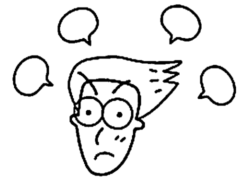


If you think of electrons as a wave, anything you say about orbits is totally unrelated.



I, Erwin Schrödinger, was ticked off at Heisenberg's thinking.

What, is he kidding? What does he mean, saying, "Don't think about the inside of the atom"?

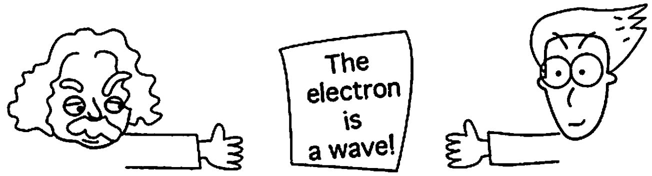


Don't be ridiculous!

Physics is about properly explaining things in nature. So if you tell me to give up midway and say okay, we'll just explain the spectra of light and let it go at that, we might as well give up on the whole thing right now.

I won't allow it.
I'm going to tell you precisely what's going on.
Like it or not, you'd better listen.

What great determination.



There you have it!

We'll start with that, that the **electron is a wave.**

Now, you can already imagine what a

is, so you can imagine the inside of the atom.

It's important to **be able to imagine** something.

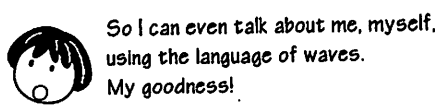
And now,

Get ready. . .

Scribble scribble scribble

$$\nabla^2\phi + 8\pi^2 \frac{m}{h}\left(\frac{E}{h} - \frac{V}{h}\right)\phi = 0$$

With this equation, you can talk about anything in the language of waves. Not just electrons, but everything else, too. .



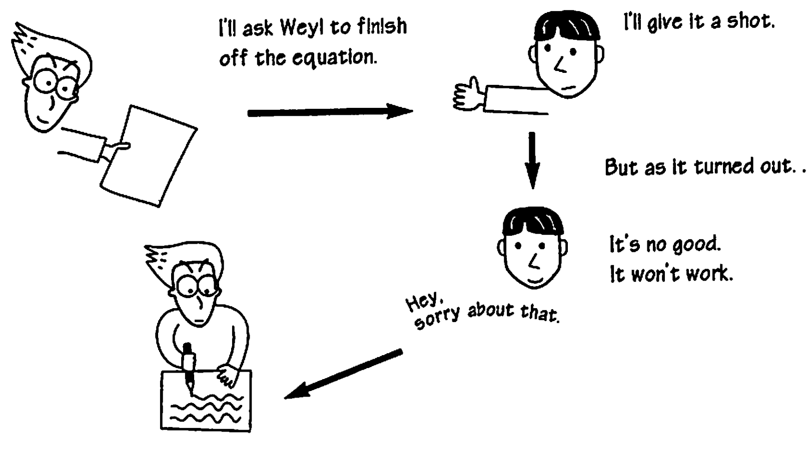
In Chapter 5

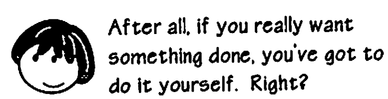
The thing is,

Schrodinger's equation expressing the energy of an atom and Heisenberg's equation expressing the energy of an atom

AMOUNTED TO THE SAME THING.

That means you don't have to deal with Heisenberg's bothersome equation. It's unnecessary. If you stick to my equation, you won't need anything else.





I'm going to do it!

Heisenberg's equation

$$\left(\frac{1}{2m}P^{\circ 2}+\frac{k}{2}Q^{\circ 2}\right)\xi - W\xi = 0$$

Schrodinger's equation

$$\frac{d^2}{dx^2}\phi(x)+8\pi^2\frac{m}{h}\left(\frac{E}{h}-\frac{k}{2h}x^2\right)\phi(x)=0$$

If we can neatly change the form of this

Clack clack bzzzzzz
(Actually, what we have to do is calculate everything.)

$$\left\{\frac{1}{2m}\left(\frac{h}{2\pi i}\frac{d}{dx}\right)^2+\frac{k}{2}x^2\right\}\phi(x)-E\phi(x)=0$$

If you take a close look,

P° and	$\frac{h}{2\pi i}\frac{d}{dx}$
Q° and	x
ξ and	$\phi(x)$
W and	E

These seem to correspond to one another.

Okay, I'll give it all I've got!

That's what I did. I threw myself into figuring out how to get rid of Heisenberg's equation. If I could use my equation to produce the values for every spectrum, in other words, to come up with what Heisenberg calculated by his equation, then my equation could stand alone, and my theory that the electron is a wave would have superseded Heisenberg's.

I struggled with it for a long time,
and I finally got rid of the matrices
that Heisenberg used.

What I finally arrived at was:

$$H\left(\frac{h}{2\pi i}\frac{d}{dx},x\right)\phi - E\phi = 0$$

The Schrödinger equation

Perfected!!

That's **magnificent!**
The calculations were exasperating,
but some interesting things came out of them.

They had to do with **the effects of language.**

In fact, in Schrödinger's equation,

the $\boxed{\frac{h}{2\pi i}\frac{d}{dx}}$ within a mathematical expression means

It's called an operator. $\times$ or $+$ or $\div$ or $\int \bigcirc\triangle\square\, dx$

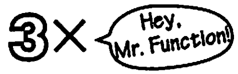
multiply add divide find the area

In a word, do what's called for in a given operation.
You can't do much with only this.

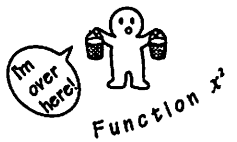
But with 

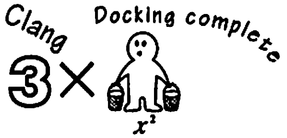
stuck on, you can do such-and-such an operation and start calculating.

For example,



Operator ⟶ times 3





$= 3x^2$

When this happens, you can calculate for all sorts of values of x, right?

At Hippo, **what this amounts to is,**

When you can say only the few things you know, language is still in the state of being an operator.

For example,
When you go to Mexico,

When a speaker successfully communicates to someone, then we can talk about meaning in language.

When a connection occurs between people, the real meaning in language comes to life.

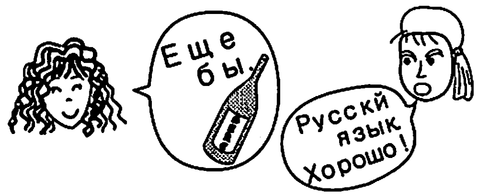
That's how it is.

Therefore,
It's very important that there be a partner.

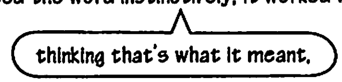
Language grows in the space between

one  **and the** **.**

Don't forget, after all, that
the meaning of words has to do with the fact that they work.



Even though she didn't understand its meaning too well, when she used the word instinctively, it worked very well.



How interesting it is that so many things are just like language!
I'm not afraid even of math now.

About that time,

The merry Schrödinger did it!

Everything in the world is a wave, a wave!!
The electron is a wave.
It is. It is!
We don't need Heisenberg's equation at all, at all.
My equation compared to Heisenberg's is so easy, so easy.
Hurrah!!

WAIT A MINUTE!!

Cool eyes  surveyed the situation. . .

Hey, Schrö, since the wave $f(\phi)$ in your equation is a wave that can be imagined, one ought to be able to know where and when it occurs.
Nevertheless, when you try the various calculations, lo and behold, you end up with **6, 9 or even more dimensions!**

So, after all this, we're back to the Heisenberg problem.
You can't maintain a visual image.

What in the world have I been doing up to now?

was my starting point to be sure, but at some point, it turned into an incomprehensible monster.

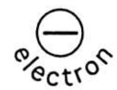
I guess my equation is still **unfinished.** However, it couldn't be entirely wrong! Whichever one you choose, mine has got to be better than Heisenberg's. **Anyway, the problems in mine will be solved in no time.**

But the problems were not solved. Even with Schrödinger's equation, the electron, in the end, remained a mysterious, unknown thing.

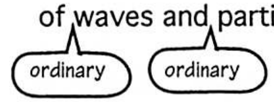
In Chapter 6

Is  a particle or a wave?

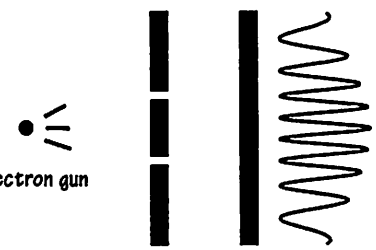
Even if you start with a
particle ⟶ an image cannot be sustained.
wave ⟶ an image cannot be sustained.

Then what in the world is  ? is an  ?

This is not the behavior of waves and particles.



In the end, I'd say this is about a wave of probability.



Electron gun

When you shoot off an electron gun at a wall through a screen with two holes, and then see where and in what quantity the electrons strike the wall, you find that they form an interference pattern.

This is a **wave**, isn't it?

But the electrons also display **particle**-like characteristics as in the Compton effect.

You really get the feeling that
they're both particle and wave.

Still. . .

If you think of it as probability, a wave of probability, then you can neatly explain everything.

Probability? Is that when, for example, the chance of a six coming up on a die is $\frac{1}{6}$, kind of like a prediction?

That's right. That's right.

So far the theories have been expressed in terms of probability. That's why it's not a question here of particle or wave.

Hey, I object to such a vague and uncertain method of resolving this!

It's true that when you apply the idea of probability, all of the numerical values and the phenomena are tied together.
I don't dispute that.

We had thought it was wave interference, and if we think of it as the interference of a probability wave, it will look as if the problem has (perhaps) gone away.

It has been said that probability exhibits interference.

But probability is a matter of approximation. Is it all right to settle for something that has accidentally ended up becoming a matter of approximation?

Up until now, the question "Are light and electrons particles or waves?" has kept everyone in a quandary.

Now Born says that it's neither (an ordinary) wave nor particle, but a **PROBABILITY WAVE**, and that probability interferes and makes a wave-like interference pattern.

Somehow, I feel like I've been tricked.

Moreover, the electron can only be thought of as a particle. What's to become of the cloud chamber experiment?

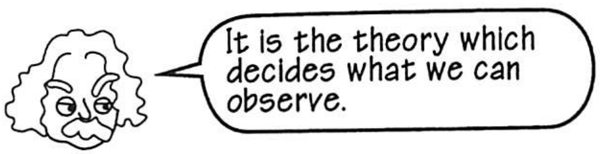
The cloud chamber experiment?. . .

A box is prepared to allow fog to form inside. Things are set up so that electrons will be emitted. After a while, electrons spurt through the fog. At that time, tracks like the contrails of an airplane become visible.

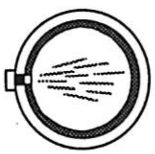
This experiment was done to prove that the electron is a particle.

HMMMM. . .
THE YOUNG HEISENBERG THOUGHT AND THOUGHT.

As Einstein would say. . .

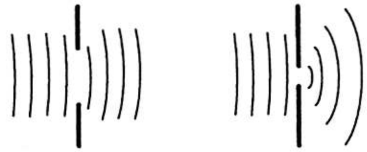


Absolutely!!



We thought we were seeing electrons flying around inside the cloud chamber.
Actually, we might have been looking at particles of fog formed by the passing electrons.

An ordinary wave 

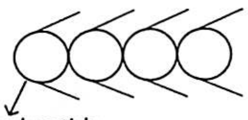


When you use a hose, if you don't squeeze it, the water flow as it comes out is about the breadth of the hose itself.

If you squeeze the end of the hose, the water goes shwee and spreads out.

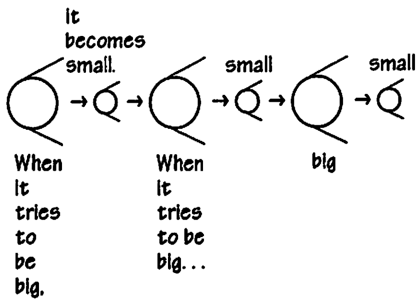
When the hose width is large ⟶ the spread is small.
When the hose width is small ⟶ the spread is large.

That's true inside a cloud chamber, too.



Cloud particle

When the probability wave of the electron tries to spread, it strikes cloud particles. The width of the cloud particle is extremely large in comparison to the electron, and the spread is small.



The end result is that it doesn't get very big. The spread doesn't fan out much.

That's why it came out looking like airplane contrails, right?

Although it's a wave, it turns out to be a wave that doesn't spread!!

This is. . .

the famous. . .

UNCERTAINTY PRINCIPLE

$$\Delta x \cdot \Delta p_x \approx h$$

It's the Planck constant!

Delta (a certain width)
Like a margin of error

If you try making this small — Δx — Δp_x — this gets bigger.

this grows bigger — Δx — Δp_x — If you make this smaller

Can't we get rid of one or both widths?

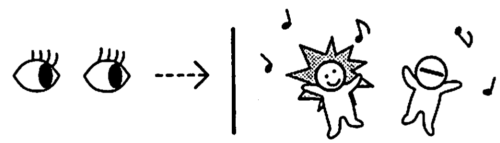
Light and Electron cannot be determined more precisely than within the width of *h*. Such light or electrons are called QUANTA.

Whee!

Now that I think about it, and without even realizing it, I've set foot inside the world of **QUANTUM MECHANICS!**

It turned out to be even more momentous.

Until now,

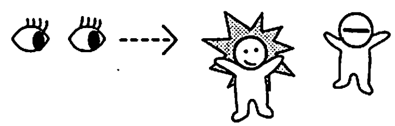


there was a clear **boundary** between the act of looking and things that could be seen.

It's the Berlin Wall!

Well, of course!

Even so. . . In the world of quanta,



The Berlin Wall crumbles!!

The condition of something appears differently depending on how it is observed.

In other words,
as it's a matter of probability,

A condition with several possibilities turns into a single condition.

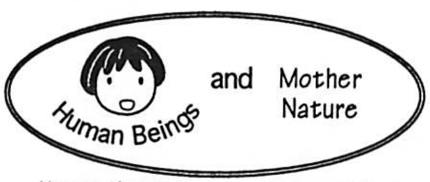
And after having seen it, you can say with confidence,

"She's singing!"

In classical mechanics,

and tried to explain her from the standpoint of people looking in from the outside.

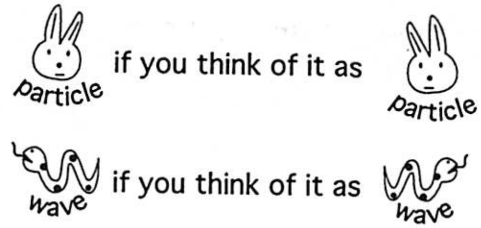
In quantum mechanics,



Nature that holds human beings within it

can be talked about from both inner and outer vantage points.

These two modes turned out to be decidedly different.



You can't think like that!

Well, everyone, what do you think?

Well. . .

EINSTEIN was furious.

You say probability!! The condition changes!!

A nature in which human beings are subsumed!!

You say that until you see it, it's a possibility, and when you see it, it's a fact!!

That's outrageous!
Nature is not fickle or vague.

There has to be an overall order to it, completely apart from humans or anything else. I'll prove it to you!

And so, he steadfastly refused to recognize the probability way of thinking.

Well, it sure is odd. . .

Even geniuses, when they get involved in new ways of thinking, sometimes don't understand exactly what they're doing.

Still, you have to admit that we can understand only the things that can be talked about and communicated through language.

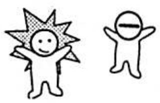
But at Hippo. . .

grammar, spelling and pronunciation

Language **isn't** something that comes to us **from outside** ourselves.

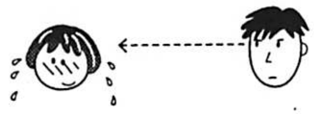
Just like a baby
— the Natural Human if there ever was one —
we go by what's happening **within ourselves.**

Rather than classical mechanics,
don't you think this is quantum mechanics?



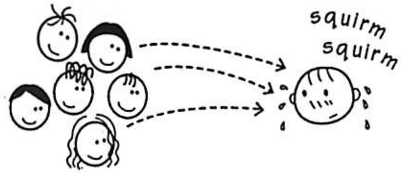
The world of quanta, considered in terms of  our world,

isn't completely strange after all!



When you're riding on a train and feel someone's gaze on you, you become a bit startled and feel self-conscious.

Maybe a baby sings at home, but a baby wouldn't just sing out if other people were around.



When many people are watching, a baby can't help but become tense and fidgety.

The act of watching changes the conditions.

It appears as if looking at something gives off some sort of energy.

The distinct sounds of each individual word and the BIG WAVE

If you try to zero in on each little sound, you won't pick up the big wave.

If you set your antennas only for the big wave, you won't pick up the little sounds.

THAT'S THE UNCERTAINTY PRINCIPLE!

It gets interesting when you think about and examine a variety of things. If you come across something interesting, think about it!

To conclude. . .

How was it?

We've touched on quantum mechanics. . .
I really want to know more about quantum mechanics. . .
Hippo is becoming more and more interesting. . .
I'm really beginning to think TCL is quite interesting. . .

It really gets interesting when you start to understand what you've striven to understand.

What do you think?

Actually, that's what I'm hoping for. Ha ha ha. . .

It's exactly the same as getting to know a language!!

Thanks for staying with us until the end.

Thank you!